

REMARKS

In response to the Examiner's objections and rejections, an amended set of claims is submitted wherein independent claim 1 has been cancelled and is replaced by new independent claim 28 which is based on former claim 1 and comprises further technical features which are supported by the specification, namely from page 3 to page 5. The wording "characterized in that" has been deleted from claims 2-25 as suggested by the Examiner. Claims 2-25 are now dependent directly or indirectly from new claim 28. In claim 16, line 2, "o" has been replaced by --of--, as suggested by the Examiner. Former claims 26 and 27 have been deleted. The specification has been amended to add appropriate subheadings, as requested by the Examiner.

New independent claim 28 recites as follows:

A device for exchange and/or reaction between at least two fluids, comprising tightly stacked modular blocks, each modular block comprising a first chamber for the flow of a first fluid and a second chamber for the flow of a second fluid, said first and second chambers being separated one from the other by a first exchange wall suitable for an exchange and/or a reaction between the fluids, wherein each modular block comprises a first spacer with a recessed center part forming said first chamber, the second chamber being formed between said first exchange wall and a second spacer, and wherein each spacer and each exchange wall is provided with four or six holes for supplying the fluids to said first and second chambers and for collecting the fluids from said first and second chambers.

The object of the invention is, as indicated on pages 1 and 2 of the disclosure, to provide a device which does not present the drawbacks of the known plate exchangers, i.e., an exchanger which can operate with loaded fluids and which is compact, inexpensive and adapted to several types of processing, such as thermal, filtering or separating, and chemical processing. This invention is neither disclosed nor suggested by the references cited by the Examiner.

Romatier discloses in US 6,190,624 a plate channel reactor comprising thin plates which are stacked and define therebetween narrow channels to provide efficient heat exchange across

the plates. Some of the plates include perforation sections allowing fluidic communication between adjacent channels.

In the embodiment shown in figures 1 and 2, the reactor 11 includes perforated plates 17 and imperforate plates 19 which are stacked and define therebetween downflow channels 15 and upflow channels 18. Each downflow channel 15 is linked at its upper end to an inlet chamber 20 and at its lower end to an upflow channel 18 by means of a perforated section 16 of the plate 17 separating the downflow and the upflow channels. The upper end of the upflow channel 18 is linked to an outlet chamber 21. Partition plates 22 segregate the volume of the inlet chamber 20 and outlet chamber 21 (see figure 2).

The plates 17 and 19 are preferably corrugated plates as shown in figures 3 to 5. The corrugation pattern serves at least two functions, one of them being to structurally support adjacent plates in order to define the channels. The other function is to promote turbulence for enhancing heat exchange (column 7, lines 56-62). Each plate 17 and 19 may also be smooth and in this case additional elements such as spacers or punched tabs may provide fluid turbulence in the channels (column 7, lines 42-45). Romatier discloses the use of spacers in the plate channel reactor. However, the function of these spacers is to promote turbulence into the channels and is not to delimit these channels.

The Examiner considers that figure 1 shows a spacer. However, figure 1 is a schematic illustration of the reactor. Figure 1 shows the reactor 11, the plates 17 and 19 defining laterally the channels 15, 18. In figure 2, the plates 22 delimit the chambers 20, 21 and it can be seen from figures 1 and 2 that the channels 15, 18 are closed at their upper ends by blankoff sections. The bottoms of the channels 15, 18 are formed by moving doors 29. There is therefore no illustration of the spacers mentioned by Romatier in the drawings. Further, there is no disclosure or suggestion by Romatier of spacers having recessed center part forming first chambers.

Moreover, according to the invention, each spacer and each exchange wall comprises four or six holes for connecting the chambers to fluid circuits. As shown in figures 3 to 5, the plates 19 do not comprise any holes and the plates 17 comprise only perforations 42 which are not intended to be linked to fluid circuits. The channels 15 and 18 of the reactor of Romatier are linked to fluid circuits by means of inlets 14 and outlets formed at the upper ends of the channels

(figure 2). Therefore, the plates 17 and 19 of the reactor 11 do not comprise any holes for connecting the channels to fluid circuits.

It follows from the above that the subject matter of new claim 28 differs from the teachings of Romatier US Patent 6,190,624 by the following features:

- the device comprises at least one spacer having a recessed center part for defining a first chamber, and
- the means for connecting the chambers to fluid circuits comprise four or six holes formed in each spacer and each exchange wall.

There is no evidence for a motivation to modify the teaching of this document to arrive at the claimed invention.

The other references cited by the Examiner do not provide such motivation.

Girod et al. US Patent 5,525,311 disclose an apparatus for controlling reaction temperatures, having a stack of parallel corrugated plates 10. This apparatus is similar to the apparatus of Romatier mentioned above.

In the embodiment of figure 3, spacers 14 are attached by welding along the sides of the plates to form channels 20, 30. Each spacer 14 is formed by a small plate and does not comprise any recessed center part for forming a chamber. Moreover, the plates 10 and the spacers 14 are not stacked together and each one of them does not include four or six holes connected to fluid circuits.

Dandekar et al. US Patent 6,180,846 disclose also the same type of apparatus having a stack of corrugated plates (figures 6 and 7). The remarks detailed above apply also for this document.

US Patent 6,919,048 of Hofmann et al. does not concern a device having tightly stacked parallel elements including at least one spacer as defined in new claim 28.

Brundage US Patent 6,602,478 discloses a reactor having a plurality of discrete heat exchangers 4A-4D arranged side by side in a common housing 6, the heat exchangers being separated one from the other by partitions 8. Each heat exchanger comprises a plurality of plates which separate the heat exchanger into a plurality of first channels 12 and second channels 16. The second channels 16 are further defined by bar-shaped spacers 18. However, these spacer bars have not recessed center parts.

Moreover, the plates delimiting these first channels 12 are not tightly stacked but are regularly spaced one from the other inside the housing (figure 1). According to the invention, the tightly stack of the elements composing the device assures the sealing of the device. The sealing of the reactor of Brundage is provided by the housing itself.

The apparatus disclosed by Romatier et al. in US 6,709,640 is similar to the apparatus of Romatier et al. in US 6,190,624.

US 5,544,703 of Joel et al. discloses a plate heat exchanger constructed by stacking ribbed plates. There is no spacer having recessed center parts between the plates.

Roussel et al. disclose in US 5,727,118 an electric boiler having also a stack of corrugated plates without spacers therebetween.

It results from the above that none of the references cited by the Examiner disclose or suggest the subject-matter of new claim 28, namely because none of them discloses spacers having recessed center parts defining chambers.

New claim 28 should therefore be considered as allowable.

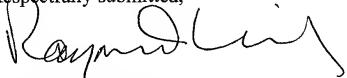
Claims 2 to 25 depend on new claim 28 and should also be considered as patentable.

The rejections under 35 USC 102(b) and under 35 USC 103 are therefore respectfully traversed.

From the foregoing, favorable action in the form a Notice of Allowance is respectfully requested and such action is earnestly solicited.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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